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BIOLOGICAL EVALUATION OF MORTALITY IN DOUGLAS-FIR PLANTATIONS ON THE GASQUET RANGER DISTRICT, SIX RIVERS NATIONAL FOREST

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ABSTRACT

The Six Rivers National Forest has an extensive acreage of Douglas-fir plantations. Little information is available on the amount of tree mortality and its causes in these plantations. Selected plantations on the Gasquet Ranger District were surveyed for mortality during the summer of 1984. One-half of these plantations had been precommercially thinned 3 or more years prior to the survey. Mortality that had occurred within the previous year was not found in any of the survey plots. However, recent mortality was observed outside of the plots in 11 plantations. All of the recently dead trees had been infected by Ceratocystis wageneri, the cause of black stain root disease. This mortality was almost always associated with some type of site disturbance. In general, mortality was insignificant in the surveyed plantations compared to other limiting factors, expecially competing vegetation. However, in a few plantations, because of the clumped nature of the mortality and the expectation that the root disease centers may increase in size, yields may be reduced below projections.

INTRODUCTION

The Six Rivers National Forest has some of the most productive forest land in California. The principal commercial tree species on much of this land is Douglas-fir. During the past 2 to 3 decades, the Forest has established plantations of this species following the harvest of mature stands. Approximately 30,000 acres of Douglas-fir plantations exist on the Gasquet Ranger District alone.

These plantations will provide an increasing amount of the harvested volume from the Forest. Limitations on the harvesting of timber from other lands and decreasing inventories of available old-growth timber will require the optimization of productivity from these lands. Minimizing losses to pests and other agents will be important in maintaining this productivity.

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The increase in plantation acreage is changing management emphasis from old-growth to young-growth stands. A shift in management activities is also occurring, along with an increase in intensity of these activities. These transitions will likely result in a change in the types of pests and the resultant damage and losses in these plantations.

Presently, we have some knowledge as to what pests may be present, but we do not know their relative importance, nor what damage they may cause. One disease of Douglas-fir that has been observed with increasing frequency during the past decade is black stain root disease, caused by Ceratocystis wageneri. The disease causes mortality, especially of seedling- and sapling-sized trees, usually in small pockets of up to 10 to 15 trees. These pockets, or root disease centers, have been found to be associated predominantly with some type of site and soil disturbance. Such disturbances include roads, skid trails, log decks, and landings. There is evidence that suggests that thinning stands induces disease development. However, the actual relationship between thinning and the incidence of black stain root disease is still being explored. As a first step to determine pest activity, we initiated a mortality survey of young-growth Douglas-fir plantations on the Gasquet Ranger District, Six Rivers National Forest.

The survey had four objectives:

1) To estimate mortality in 15- to 30-year-old Douglas-fir plantations on the Gasquet Ranger District, Six Rivers National Forest.

2) To determine the pests involved in this mortality.

3) To determine the incidence of root diseases, as expressed by tree mortality, in the selected plantations.

4) To examine the relationship of the incidence of black stain root disease with precommercial thinning.

METHODS

A listing of 40 randomly selected Douglas-fir plantations was obtained from Gasquet Ranger District personnel. These plantations were planted between 1957 and 1972. One-half of the plantations were precommercially thinned between 1975 and 1981. Within each group, thinned and unthinned, the plantations were randomly prioritized. The first 15 plantations in each group were surveyed, with the last 5 being used as replacements, if necessary.

Each plantation was surveyed by following transects perpendicular to ridges and drainages. The transect was started at a randomly selected point on the plantation boundary. Parallel transects were separated by at least 3 chains. At 2 chain intervals along a transect, 0.01 acre circular plots were established. The number of live and dead trees greater than or equal to 1.0 inch dbh were counted by species in each plot. Dead trees were separated into those dead 1 year or less (recent dead) and those dead more than 1 year (older dead) based

on characteristics described in the Region 5 Timber Management Plan Inventory Handbook. Recently dead trees were examined for the causes of mortality. Approximately 1% of the land area of each plantation was surveyed in this manner.

RESULTS

No current mortality of any species was identified in the survey on any of the 30 plantations. Older dead Douglas-firs were observed in 5 plantations (see Table). These tended to be scattered individuals. In some of the plantations, such as Siskiyou Fork A and Siskiyou Fork D, they were associated with dense clumps of trees and mortality was likely a result of suppression. In French Hill E-5, however, these older dead trees were in black stain root disease centers that also included declining Douglas-firs.

Although recent mortality was not detected in the survey, recently killed or declining Douglas-firs were observed in 11 of the surveyed plantations. All of these dead and declining trees had stain symptomatic of black stain root disease. In almost every occurrence, the diseased trees were associated with some form of site disturbance, including roads, skid trails, landings, and terraces. Of the 11 plantations, 9 have been precommerically thinned.

Mortality was the only type of damage for which data was collected. Two other types of damage were observed. In Craigs Creek 6, the tops of numerous Douglas-firs were dead. The type of damage and the presence of nests implicates the dusky-footed wood rat (Neotoma spp.) as the cause. A less obvious, but much more significant damage is occurring in many of the plantations from the effects of competing vegetation. These effects were not quantified in this survey. However, it was obvious in some plantations that overtopping brush was suppressing height growth. The amount of competing vegetation in other plantations also suggested that diameter growth was being limited. No other types of damage, such as stem cankers from Dermea pseudotsugae or top-kill from Scolytus unispinosus, were observed.

DISCUSSION

The inability of the survey to detect any recent mortality can be attributed to two factors: the low intensity of the survey and the low incidence of mortality. To increase the probability of detecting mortality the survey methodology could be changed by either increasing the intensity or altering the design. A strip cruise, rather than small plots, might be more appropriate. Mortality would have been picked up in several plantations during our survey if we had been running strips rather than plots.

Even though other survey methods may have been more appropriate, the amount of mortality in these plantations is still small. This lack of mortality suggests that insects and diseases are not significant factors in this life stage of the plantations. However, in certain plantations, most notably those near French Hill, the amount of mortality, especially because of its clumped nature, may be of concern. In these plantations, several root disease centers exist that are

expanding and creating openings in the stands. Because the plantations have been precommerically thinned, this loss of trees may reduce stocking levels below what is desired and result in a reduction in projected timber productivity.

The last question, is there a relationship between the incidence of black stain root disease and precommercial thinning, cannot be answered by this survey because of the lack of measured mortality. Observations of black stain root disease in 9 out of 15 thinned plantations as opposed to 2 out of 15 unthinned lends credence to the hypothesis, however. It has been suggested that this relationship is actually a result of the fact that thinning usually occurs in plantations on more level terrain which are more likely to have been tractor rather than cable-logged. Tractor-logging, causing more soil disturbance, may be more conducive to infection and development of the disease. The majority of infection centers in thinned and unthinned plantations occurred in or bordering an area where the soil had been disturbed.

Several of the thinned plantations with black stain root disease have had only part of their area precommercially thinned. This provides the opportunity to more closely examine these plantations and compare the incidence of black stain root disease between the thinned and unthinned portions of each plantation, with only the thinning being different between each portion. In actuality, other factors, such as prethinning stocking levels and soil type, may also be different. Two plantations where black stain was observed, French Hill E-5 and French Hill P&M1, have been photographed from the air and the detected mortality will be verified on the ground. Comparison of the amount and cause of mortality between the thinned and unthinned portions of each plantation can then be done to examine the hypothesis that precommercial thinning induces mortality from black stain root disease. Until this is completed, present management activities should continue. The relationship between precommercial thinning and black stain root disease is not sufficiently clear to merit ceasing thinning operations.

The primary purpose of this evaluation was to measure mortality and its causes. During this process it was quite evident that concerns other than insects and diseases and direct mortality need to be addressed first by District personnel. In many of the plantations, the competing vegetation had to be having a deleterious effect on growth and survival. Not only was there a physiological effect from reduced moisture, nutrients, and sunlight, but in some situations, the snowbrush was so dense and heavy that it was physically forcing the Douglas-firs to bend and develop tremendous sweep. Unless this competition can be reduced early in the life of the plantation, optimum productivity should not be expected and insect and disease activity will have a minimal influence on this reduction.

TABLE. STOCKING LEVELS AND MORTALITY IN PLANTATIONS ON THE GASQUET RANGER DISTRICT, SIX RIVERS NATIONAL FOREST

STAND[1/]	NUMBER OF GREEN TREES/ACRE					NUMBER OF
	DF[2/]	PP	SP	KP	WH	POC	OLD DEAD/ACRE
Siskiyou Fork A	408	-	8	-	-	8	8
Siskiyou Fork D*	450	-	-	-	-	-	6
Fall Creek IF	120	-	-	-	-	-	-
Fall Creek II-2	708	-	-	-	-	-	-
Fall Creek II-3	204	75	-	-	-	-	-
Fall Creek ID*	194	-	-	-	-	-	-
Fall Creek IC*	144	-	-	-	-	-	-
Fall Creek IQ*	427	-	-	-	-	-	-
Jawbone I-1	290	40	-	-	-	-	-
Little Jones 22 (Unthinned)	238	-	-	-	-	-	-
Little Jones 22 (Thinned)	200	-	-	-	-	-	-
Little Jones 23	221	-	-	-	-	-	-
French Hill P&M1*	184	25	6	9	-	-	-
French Hill E5*	193	-	-	-	-	-	13
French Hill F3	187	-	13	-	-	-	-
Boulder Creek 12*	257	-	-	-	-	7	-
Fox Ridge I-4*	190	-	-	-	-	-	-
Craigs Creek 6	286	-	-	-	-	-	-
Jones Ridge 5	800	-	-	-	-	7	-
Craigs Creek 8	193	-	-	-	-	-	-
Horse L	600	-	-	-	-	-	-
Blackhawk P&M1	280	-	-	-	-	-	3
Lake 1	225	-	-	-	-	-	-
Boulder Creek 7*	344	-	-	-	-	6	6
Jones Ridge 7*	800	43	-	-	7	43	-
Boulder Creek 10	472	-	-	-	-	61	-
Fox Ridge I-6*	195	-	-	-	-	-	-
Cant Hook II-1	170	-	-	-	-	10	-
Boulder Creek 9	259	-	12	29	-	-	-
Horse A	311	-	-	-	-	-	-

1/ An asterisk indicates black stain root disease was observed in this plantation.

2/ Species code: DF-Douglas-fir, PP-Ponderosa pine, SP-Sugar pine, KP-Knobcone pine, WH-Western hemlock, POC-Port-Orford-cedar.